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On four Ascidian species new in the Ionian Sea

par Angelo Tursi *

Résumé. — Quatre espèces peu connues d'Ascidies littorales nouvelles pour la mer Ionienne sont décrites ici. Ce sont : *Pseudodistoma cyrnusense* (Pérès, 1952), *Aplidium hyalinum* (Pérès, 1956), *Phallusia ingeria* Traustedt, 1883, et *Molgula rheophila* (Pérès, 1956).

Les trois premières ont été décrites de la Méditerranée mais n'avaient pas ou peu été retrouvées, *M. rheophila* est ici décrite comme une espèce, Pérès la considérait comme une variété de *Molgula impura* Heller, 1877.

Abstract. — Four interesting species of littoral Ascidians found in the Ionian Sea are described again. They are : *Pseudodistoma cyrnusense* (Pérès, 1952), *Aplidium hyalinum* (Pérès, 1956), *Phallusia ingeria* Traustedt, 1883, and *Molgula rheophila* (Pérès, 1956).

While the first three species had been described but rarely found in the Mediterranean Sea, probably because they were confused, as regards *Molgula rheophila* it is a matter of a new description as a species since previously this species had been described as a variety of *Molgula impura* Heller, 1877.

Riassunto. — Quattro specie interessanti di Ascidie litorali rinvenute nel Mar Ionio sono ridescritte. Esse sono : *Pseudodistoma cyrnusense* (Pérès, 1952), *Aplidium hyalinum* (Pérès, 1956), *Phallusia ingeria* Traustedt, 1883, e *Molgula rheophila* (Pérès, 1956).

Mentre le prime tre specie erano state descritte ma raramente rinvenute nel Mediterraneo, probabilmente perché confuse, per la *Molgula rheophila* si tratta di una nuova descrizione come specie dato che precedentemente questa specie era stata descritta come varietà della *Molgula impura* Heller, 1877.

Introduction

During dredgings carried out systematically in the Ionian Sea both by the Institute of Zoology of the University of Bari, the Cerruti Marine Biology Institute of Taranto and the Laboratory of Marine Biology of Porto Cesareo (Lecce), four interesting littoral species of Ascidians were collected and they are examined here.

On this subject, one must keep in mind that from the systematic point of view the fauna from the Ionian Sea and in particular that of Ascidians is largely unknown. At the moment the little information on Ascidians from the Ionian Sea has been obtained from Taranto and its two seas (« Mar Grande » and « Mar Piccolo ») based upon the research of Cerruti (1948), Parenzan (1960) and Tursi, Pastore, Panetta (1974), Tursi, Gherardi, Lepore (1974), Lafargue, Tursi (1975).

Recently a collection of Ascidians from Porto Cesareo (Lecce) was examined by Tursi (1971) and general study of Ascidians collected during two surveys in the Ionian Sea is in press (Tursi, 1975).

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The Ascidians discussed here are unknown on the Ionian coasts or have not yet been sufficiently described. The specimens have been examined in the Biology Laboratory of Marine Invertebrates of the National Museum of Natural History, in Paris, with the help of C. and F. Monniot, whose assistance is gratefully acknowledged.

Materials and methods

All the specimens come from dredgings carried out by a triangular dredge, each side 50 cm, long dragged by a boat for about 50 m. The Ascidian specimens, preserved in 10 % neutral formalin, were examined later following the method described by Monniot (1965). Drawings have been carried out by means of camera lucida. The specimens are deposited in the Muséum national d'Histoire naturelle, Paris.

Pseudodistoma cyrnusense Pérès, 1952
(Fig. 1, A-C and 2, D)

Loc. : Dred. 394.

The colony (fig. 2, D) is in the shape of an oval, with rounded edges, barely pedunculated. It is practically without incrustations except for the basal part of the pedunele where some sand may be observed. The dimensions of the colony are : 4,5 cm high ; 2,7 cm large ; 1,5 cm thick. The colour of the formolized colony is yellow-reddish. The middle part is pink and opaque owing to the presence of zooids at this level, whereas the peripherical part is almost transparent and without zooids. The colony is soft on the top but it becomes harder at the pedunele level. The zooids are easily taken out from the test.

The zooids, grouped in the central part, are extended lengthwise along the colony. There are no systems and the zooids are almost parallel between them. The dimensions vary greatly from individual to individual. They are adequately developed and reach an average dimension of 11 mm on 2 mm.

The examined colony shows some larvae in the oviduct, which increase the width of the zooids. The proportions between the thorax, the abdomen and post-abdomen are 1 : 1 : 4 (fig. 1, A) on an individual which is not very contracted and having a long post-abdomen. In an individual with a shorter post-abdomen the proportions are 1 : 1 : 2.

On the average 5 larvae are incubated in the oviduct but I examined some zooids in which the number of larvae varied from 2 to 10. The larvae are situated immediately above the male follicles up to the basal part of the branchial sac and also in the atrial cavity. The oral, tube-shaped siphon shows 6 rounded lobes of normal dimensions. The atrial siphon, on the contrary, is more extended, tube-shaped, with 6 small lobes very flattened and often difficult to see owing to their contraction. The atrial siphon is often at the same level as the oral siphon and sometimes a bit higher.

An interesting point to note is that the zooids show 3 lighter spots, one of which surrounds the top of the endostyle while the other two are situated on the two sides of the dorsal ganglion. These lighter spots are very visible on the formolized animal, whereas they tend to disappear in the zooids included in balsam.

The musculature is not remarkable at thorax level. The number of tentacles is about 16. It is possible to count 3 rows of stigmata ; between the 3rd row and the lower part of the

branchial sac, remains a space nearly equal to a row of stigmata. In the branchial sac it is possible to count 15 to 20 stigmata on each side.

The stomach is situated rather low, a bit above the intestinal loop.

It is preceded by a very long oesophagus nearly equal to double the length of stomach. This is smooth, nearly trapezoidal.

Some individuals show two thicker longitudinal lines in their stomach, simulating folds. They do not show a very clear post-stomach.

The middle intestine shows a loop after which there is a stricture where the back intestine begins with two little caeca which are barely developed.

The intestine goes straight up towards the branchial sac, with a weak torsion. The anus is situated at the level of the second row of stigmata. The male follicles are situated after a small ovary in the last fifth of the animal. The male follicles are scattered in the post-abdomen but they are arranged lengthwise up to heart level.

The sperm duct is straight. The distance between the intestinal loop and the beginning of the male follicles is variable ; it may be 2/5 to 1/5 of the total length of the animal.

The average number of male follicles is 30, with a minimum of 20 and maximum of 60. It must be noticed, however, that examined zooids had already passed their male period (there were very mature larvae). Two vascular processes, which are not very developed lengthwise, are also visible in the post-abdomen base. The heart is visible in the terminal part of the post-abdomen. The musculature in the post-abdomen is relatively well developed and, in general, it is possible to count about ten muscular bundles on each side, which are collected together below the heart.

The larvae (fig. 1, B-C) are very developed : 1 mm long by 0,5 mm large. A round ocellus is visible above a typical otolith. Three papillae separated by four pairs of extended ampulla can be counted. In some larvae the digestive tube is rather visible.

It is interesting to note the presence of this species in the Ionian Sea, which extends the distribution of *Pseudodistoma cyrnusense* eastwards in the Mediterranean Sea. It was previously known in the western Mediterranean basin (Alboran Sea, Balearic Islands, Corsica) whereas it has now spread to the eastern part.

This species is easily recognizable thanks to its smooth stomach and its pigmented spots on the thorax. The abundance of the species of the genus *Pseudodistoma* in the Mediterranean Sea, a genus which is rather rare in the rest of the world, should be given special notice.

Aplidium hyalinum (Pérès, 1956)
(Fig. 1, D)

Loc. : Dred. nº 15, 114, 214, X 1.

The colony which is greyish, transparent and soft has a gelatinous appearance. It adheres to a leaf of *Posidonia*. The colony shape is nearly conical.

The size is 2 × 1 cm. At the base of the colony there is a bit of sand. The systems are absent.

The zooids have an average length of 6 mm (fig. 1, D). The proportions between the thorax, the abdomen and the post-abdomen are : 1 : 2 : 3.

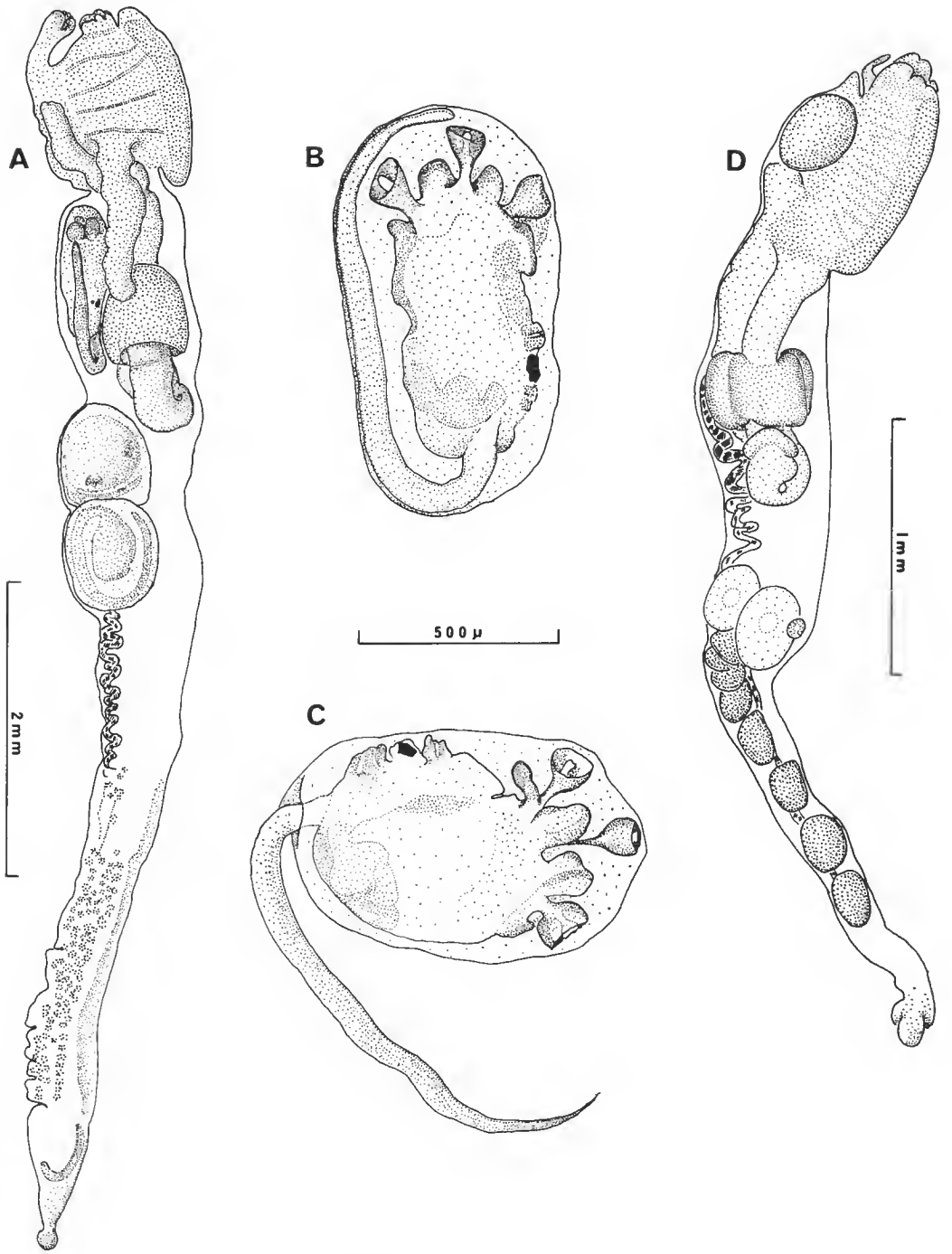

Fig. 1. — A-C, *Pseudodistoma cyrnusense* Pérès, 1952 :
A, zooid ; B-C, tadpole larvae. D, *Aplidium hyalinum* (Pérès, 1956) zooid.

The oral siphon has six lobes in a round shape whereas the atrial siphon, situated at the level of the third row of stigmata has a simple languet with variable size, according to the individuals.

In the branchial sac there is an average of 12 rows of stigmata.

The oesophagus is a bit longer than the stomach. The latter is more long than large (about 1.2 times) and shows five folds on its surface. The post-stomach forms a loop.

The intestine is typical of the genus. The anus is situated at the level of the ninth row of stigmata. A post-abdomen, rather long, includes 4 to 6 male follicles arranged in a simple row below the ovary. In some individuals up to 11 male follicles have been counted. The ovary is far from the intestinal loop. The sperm duct is very clear.

The presence of this species in the Ionian Sea extends the distribution of *Aplidium hyalinum* in the eastern Mediterranean Sea. It was unknown but for the description of Pérès (1956) starting from animals coming from Tunisia.

The species is not noticed in the western Mediterranean Sea (Banyuls-sur-mer, Marseille etc.). In 1958 Pérès already assumed that this species was endemic in the eastern Mediterranean.

Phallusia ingeria Traustedt, 1883
(Fig. 2, A-C)

Ascidia marioni Roule, 1884 : 240, pl. X, fig. 91, pl. XIII, fig. 126-127.
Ascidia conchilega forme *marioni* Harant, 1931 : 81 ; Harant et Vernières, 1933 : 43.
part *Ascidia conchilega* Salfi, 1931 : 330.
Ascidia ingeria Monniet C. et Monniot F., 1971 : 1191, fig. 2, A.

Loc. : Dred. n° 19.

I have found only one specimen of this species. The general outer feature of this species reminds one of those of the genus *Ascidia* were it not for many minor openings of the neural gland which are typical of *Phallusia* genus.

The specimen size is 3 cm long and 1,5 cm large. The colour is translucid white. The test is transparent, rather soft and shows some typical papillae on its surface, whereas there are neither epibionts nor sand nor debris.

It has a basal fixation and its atrial siphon opens in the middle of its body. There are 45 filiform tentacles grouped in three sizes.

The peripharyngial groove appears thin and straight, far from the very tiny dorsal tubercle which is C-shaped.

The neural gland is about two and a half times its length away from the dorsal tubercle and it has several minor openings along its duct (fig. 2, B-C).

The dorsal lamina edge appears as a double lamina for 1/10 of its length. Afterwards it is normal up to the entrance of the oesophagus, beyond which it becomes rather indistinct.

The oesophagus opens at about 2/3 of its total length ; at this level the transverse bars on the right form big papillae which are sometimes lobed. The dorsal lamina disappears almost completely after its entrance into the oesophagus. The smooth endostyle is typical.

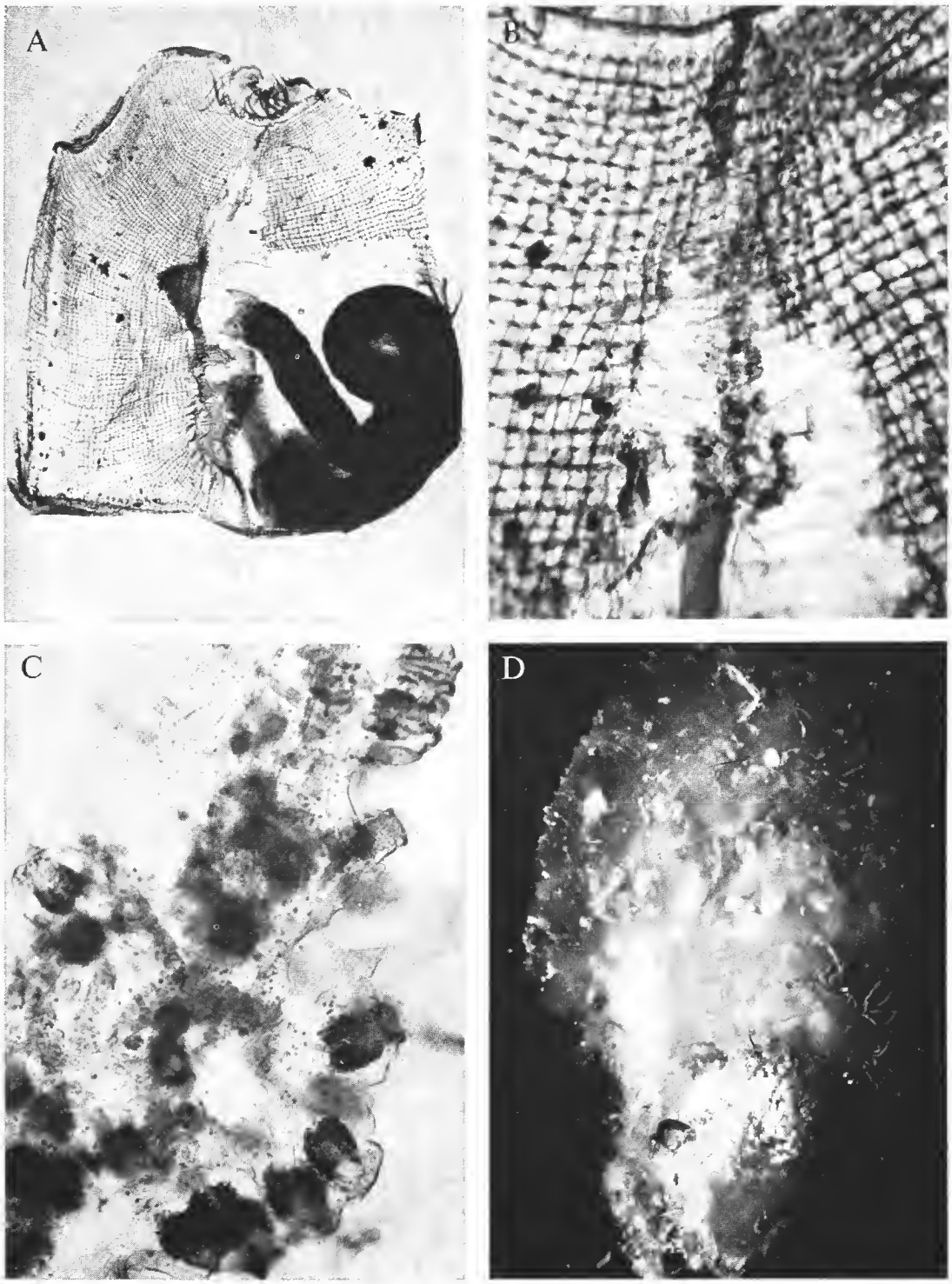

Fig. 2. — A-C, *Phallusia ingeria* Traustedt, 1883 : A, specimen without tunic opened by ventral side, branchial sac partly removed × 4 ; B, neural gland, with accessory openings (× 27) ; C, detail of accessory openings (× 100). D, *Pseudodistoma cyrnusense* Pérès, 1952 : colony of 5 cm high.

The branchial sac is not very thick ; there are 62 longitudinal bars on the right and 45 on the left. The minute plication is unremarkable. The branchial papillae on longitudinal bars at intersections with transverse bars are rather remarkable. The intermediate papillae, when they exist, are much shorter (1/4 of the primary papillae). They are linked, but not always, to the interstigmatic vessels. These vessels do not always appear. The longitudinal bars have the shape of a tube. There is a squaremeshed grid with four extended stigmata. In the front part of the body, there are about ten longitudinal bars on the right and three on the left end against the dorsal lamina.

The straight oesophagus is nearly the same length as the stomach, which is ovoid. The intestine shows two closed loops ; the primary loop is situated at the same level as the atrial siphon, whereas, the secondary loop is at the stomach level. In both cases loops are very tight (fig. 2, A). The anus is at the same level as the intestinal loop and the atrial siphon. Unfortunately, the individual examined was completely immature. The renal vesicles are large and limited to the stomach surface and do not appear on the intestine.

Discussion

The specimen examined corresponds undoubtedly to the one described by Traustedt (1883) in the gulf of Naples. The fact that it is a *Phallusia* is supported by the numerous openings in the neural duct. On the contrary, the species described by Roule (1884) by the name of *Ascidia marioni* is probably the *Phallusia ingeria* ; actually the openings of the neural duct (which make a *Phallusia* of it), the size, the papillae on its test, the renal vesicles, are also characteristic of *Phallusia ingeria*. Unfortunately, Roule does not give either a drawing or a description of the shape and position of the intestinal loop, which might have removed any doubts.

So, I do not agree either with Harant (1931) nor with Salfi (1933) who consider this species a form of *Ascidia conchilega*, which has some papillae on the right of the dorsal lamina that are completely absent here.

The *Ascidia ingeria* described by Monniot C. and Monniot F. (1971) is in reality also a *Phallusia ingeria* (personal communication of the authors).

Thus, the distribution of this species is as follows :

Gulf of Naples (Traustedt), Northern Adriatic (Monniot and Monniot), Marseille (Roule, Harant), Sète (Harant), Atlantic coast of Morocco, Fedhala beach (personal communication of Monniot C. who examined some specimens collected by Liouville).

Probably this species is more abundant than we think, but it has often been confused with *Ascidia conchilega* Müller, 1776, which resembles it closely, because of its intestinal loop, although it has a neural duct without any secondary openings.

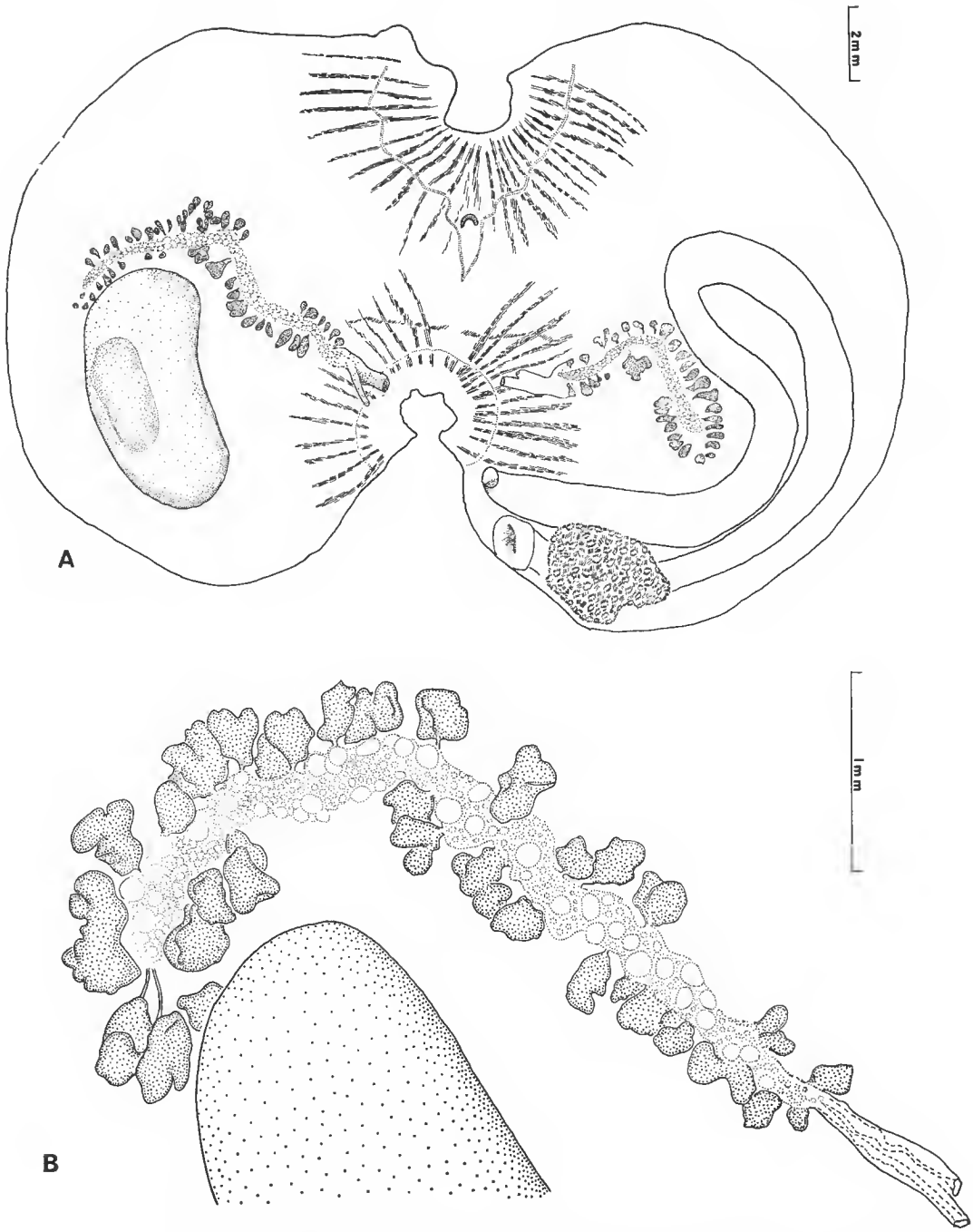

Fig. 3. — *Molgula rheophila* (Pérès, 1956) : A, specimen ; B, right gonad.

Molgula rheophila (Pérès, 1956)
(Fig. 3)

Molgula impura Heller var. *rheophila* nov. var. Pérès, 1956.

Loc. : Dr. 300, 377, 394.

The test is fully coated by sand shell. If debris is taken off, the dark grey colour of the test and little fibrils on it are visible. The size of the specimens examined is about 2 cm long, 1,5 cm high and 1,3 cm thick.

The muscles are visible round the siphons and I have counted about 12 bands on the left and 12 on the right, both round the oral siphon and the atrial siphon. Particular spots are often visible in the inner part of the siphons ; they are not produced by a pigment, but, on the contrary, by an optical phenomenon seen as blue-greenish spots of irridescence, such as those described by Monniot (1972) for *Pyura munita* (Van Name, 1902) and *Pyura momus* (Savigny, 1816).

It is possible to count an average of 16 oral tentacles of three sizes. The oral tentacles of the first size are very long and reach the siphonal diameter. Three orders of ramification are present mostly on the large ones, and two orders on others.

The very marked peripharyngial groove has a typical feature : it comes down to the level of the opening of the dorsal tubercle which is often located at a distance of about 2/5 of the intersiphonal distance.

The opening of the dorsal tubercle is small, C-shaped.

The dorsal lamina of course is shorter than usual, owing to the position of the dorsal tubercle and it is smooth and a bit shorter than the branchial folds. It enters the oesophagus directly.

Six branchial folds are present in the branchial sac which is not very thin. The markedness of the peripharyngial groove gives a particular feature to the branchial sac, since the first dorsal folds are very short as they are linked to the peripharyngial groove under the dorsal tubercle.

The internal longitudinal vessels in a large adult were arranged as follows :

Left : R. 1 (10) 1 (11) 1 (11) 1 (11) 1 (11) 1 (8) E ;
Right : R. 1 (10) 1 (11) 1 (10) 1 (10) 1 (10) 1 (10) E.

The folds do not overlap and it is possible to see the longitudinal bars of the following folds. The longitudinal bars look like thin and short laminae. The branchial papillae are not visible. The stigmata are rather regular and infundibula are not seen.

The oesophagus (fig. 3, A) is short and enters a stomach covered by a green liver with big papillae. The tubular intestine has the same dimensions up to the smooth anus. It is very interesting to note that the primary intestinal loop is not closed but forms an obtuse angle.

The gonades (fig. 3, B) are also very typical. There are two of them and they are located on each side of the body. There is a big difference between them ; in fact, whereas the right gonad surrounds the renal sac, the left one is situated in the secondary intestinal

loop. It begins near the terminal portion of the gut and runs parallel to it, towards the ventral part of the body. In the middle of its length the left gonad turns at 90° and continues directly towards the atrial siphon. This feature is the same in all the specimens examined. The male follicles are numerous and are situated in both sides of the elongate ovary. There is an inner sperm duct situated on the ovary, whereas the oviduct is found between the ovary and the mantle. The male and female papillae are long linked to each other and detached from the mantle. A little atrial velum is present.

Discussion

Up to now the specimens described by Traustedt (1883) and Monniot (1969), as *Molgula occidentalis*, by Heller (1877) as *Molgula impura* and by Pérès (1956), as *Molgula impura* var. *rheophila*, were categorised with the same specific name. *Molgula occidentalis* and *Molgula impura* are the same. On the contrary, *Molgula rheophila* which I describe here is separated from *Molgula occidentalis* owing to some features which I thought were enough to form a separate species. In fact, the left gonad has a very particular and constant feature and agrees perfectly with the descriptions given by Pérès (1956). Moreover, as shown in figure by Pérès, the secondary intestinal loop is less closed than the one of *Molgula occidentalis*. Finally, the peripharyngial groove, forming a very deep fold at the level of the dorsal tubercle and the shortening of the dorsal lamina and of the dorsal folds, are characteristics as specific as the other ones. For this reason, I consider the variety of Pérès as a species with the following diagnosis :

Molgula rheophila (Pérès, 1956).

Molgula with six branchial folds on each side ; right gonad S-shaped surrounding the end of the renal sac ; left gonad, L-shaped, with posterior concavity the distal part of which is not attached to the rectum ; the branches of the intestine are not linked together during most of their path. The secondary intestinal loop, not very closed, takes the shape of an obtuse angle.

The peripharyngial grove with the fold very deep at dorsal tubercle level is situated at about 2/5 of the intersiphonal distance. The arrangement of the left gonad, L-shaped, with posterior concavity, is typical and is not present in any other species of *Molgula* in the world with the right gonad surrounding the renal sac.

Conclusions

So, the four species described are important for different reasons. Whereas for *Molgula rheophila* it is a matter of a description of a new species (although it is known by Pérès (1956) as a variety) for the other three species it is a matter of pointing out a discovery, as they are very rare in the Mediterranean Sea.

The importance of the discovery of the four species described once more emphasizes the necessity of a closer examination of the Ionian Sea, an examination which must be done above all from the strictly systematical point of view. I think, in fact, that these four species of Ascidians are part of a greater number of rare species which should be discovered by the next survey in the Ionian Sea.

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